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TITLE: Intensification of maize-legume based systems in the semi-arid areas of Tanzania (Kongwa and Kiteto districts) to increase farm productivity and improve farming natural resource base

SUBJECT:LESSONS LEARNT AND IMPLICATIONS FOR SCALING-UP RESEARCH FINDING FROM AFRICA RISING RESEARCH FOR DEVELOPMENT ACTIVITIES IN KONGWA

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**SUMMARY**

The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program is a research for development (R4D) investment supported by the United States Agency for International Development (USAID) as part of the U.S. Government’s Feed the Future global food security initiative. The aim of this program is to provide a scientific basis for sustainably improving agricultural productivity in semi-arid areas of central Tanzania. The main achievements generated by multiple national and international stakeholders include the following areas:

1. **Generation of crop production and productivity enhancing technologies**. Well adapted cereals (maize, sorghum and pearl millet) and legumes (groundnuts, bambara nuts and pigeonpea) with over 120% yield advantage have been tested and identified. For example, quality protein maize (QPM) that yield 2.03 tons/ha compared to the commercial variety KILIMAQH06 with 0.41 tons/ha. Sorghum yielding 4 tons/ha and pearl millet yielding 3 tons/ha have been identified. Groundnut and pigeonpea with yield advantage of up to 122% validated. Bambara nut with a 126% yield advantage validated. Reduced fertilizer wastage by 50% at 15 kg phosphorus per hectare compared to 30 Kg phosphorus per hectare.
2. **Livestock production and productivity**. Enhanced pasture management based on improving the Maasai traditional pasture management system (*Alalili)*, has been tested in Kiteto. Nutrient rich legume trees and pastures species e.g. *Gliricidia* to supplement livestock feed during season and off season have been established. Fodder banks have been established in Moleti and Chitego in Kongwa. Fast growing cross-bred chicken for meat and egg production have been introduced and popularised with egg production increased from 70 to 240 eggs per annum. The crosses have higher meat production potential of 3.5-4.0 kg per chicken than local chickens (0.75-1.0 kg).
3. **Improved natural resource management**. The team has developed and started promoting erosion control and rain water harvesting technologies to improve the use of limited rain water and increase land productivity. The new technologies such as tie-ridging reduce rain water runoff to 18.9 mm compared to 102.3 mm under tractor tillage. Improved tillage practice reduced soil loss from 126 tons/ha to 9 tons per ha. Yields of maize improved 4 times at 3.8 tons per ha compared to 0.7 tons per ha under farmer practice. Agroforestry reclamation of land to control wind erosion and improve soil fertility has been tested with over 35,000 tree seedlings distributed. An agroforestry learning site has been established in Moleti.
4. **Nutrition, food safety and security**. The hot spots for aflatoxin contamination in legume and cereal grain in both districts has been mapped and the contamination profile from the field, under storage and markets studied. Food scarcity periods have also been mapped and feeding recipes for aflatoxin safe-food for infants (under five-year old) and lactating mothers tested. Mothers have been trained on the use of such recipes.

**BACKGROUND**

The overall aim of Africa RISING is to transform agricultural systems through sustainable intensification projects in West Africa, East and Southern Africa and Ethiopian Highlands three regions of Africa. In East and southern Africa, the focus countries are mainly Malawi and Tanzania with Zambia added in 2015. In Tanzania, the project districts are Babati, Kongwa and Kiteto. Implementation in Kongwa and Kiteto is led by the International Crops Research Institute for The Semi-Arid Tropics (ICRISAT) and includes: World Agroforestry Center (ICRAF), Sokoine University of Agriculture, University of Dodoma, Agricultural Research Institute Hombolo and District Councils of both districts. It also leverages complementary projects such as the USAID supported Nafaka project. Africa RISING activities in Kongwa and Kiteto have been implemented since the 2012-2013 cropping season. Our research agenda aims to address three main agriculture and environment related problems.

1. Low productivity of crop and livestock systems and fragile production to market value chains.
2. High vulnerability of communities to weather, natural disasters and nutritional deficiency.
3. High levels of food insecurity and poverty with over 50% expenditure on food rather than broader livelihood challenges.

The activities in both districts are being implemented through a process whereby best practices and results from the previous years are used to inform design and subsequent work. Implementation is based on four areas or themes. Theme 1, tests and deploys highly resilient and productive crop varieties; Theme 2, tests and validates crop management practices such as intercropping and crop-tree livestock and water management systems to conserve water and soil, increase mutual benefits between crops livestock; Theme 3, focuses on food safety and nutrition and, Theme 4, provides mechanisms for working with stakeholders and scaling-up technologies.

**CONSIDERATIONS**

Our four year research for development activities revealed the following key areas to consider for further investments in research and development activities:

1. **New drought tolerant and disease resistant crop varieties identified**: New high yielding maize, other cereals (sorghum, pearl millet) and legumes that are well adapted for these semi-arid ecologies have been identified and or released (groundnut + QPM maize) for commercialization;
2. **Improved low-resource use efficient technologies for soil fertility**. Intercrop combinations- (fodder trees and maize, pigeonpea and maize, sorghum) and soil fertility management options were developed;
3. **Improved soil heath and soil water management**. Working with communities we have tested erosion control technologies that also combine improved land preparation (tillage) to reduce water run-off and increase absorption into the soil. These combined approaches reduce soil and nutrient loss and increase productivity by 4 times restoring degraded land;
4. **Improved livestock productivity**. The team has identified new locally adapted legume browse species for integration into rangelands and erosion management, Fodder banks using fertilizer- leguminous trees have been established in Moleti, Laikala, Mlali, Manyusi (Chitego) in Kongwa. Selected grazing lands at Manyusi have been improved with enriched highly nutritious local legume fodder species. Poultry production based on highly productive local chicken have been tested with farmer groups in Mlali and Manyusi. Trials in Kiteto were unsuccessful due to losses.
5. **Food safety and nutrition**. Lead farmers in all villages in both districts (), as well as extension staff (Kongwa **50** & **23** for Kiteto) were trained on post-harvest management of grains to minimize aflatoxin contamination. **100** mothers have been trained and learning team of **20** mothers and their children tested locally formulated protein and energy rich aflatoxin free weaning food. Preliminary results show improvement in child growth and health.
6. **Capacity to use new technologies**. The team has trained **73** extension staff on post-harvest management and seed systems. An aflatoxin testing facility has been established at Sokoine University of Agriculture to serve traders and processors in the region. Field based testing tools have also been developed and readied for deployment.

**CONCLUSION AND RECOMMENDATIONS**

1. **Mobilisation for capacity development to roll-out new technologies and knowledge**
   1. ***Extension staff***: The District Council should identify and nominate candidates for short term training to lead knowledge and technology dissemination. These staff will be the lead trainers for agriculture/environment, livestock and food safety /healthy promotion activities.
   2. ***Lead farmers***: The District Council should identify additional lead-farmers who will work with lead famer and extension staff for knowledge and technology dissemination.
   3. ***Capacity strengthening of local communities*** **and village governments:** Thedistrict council should help in mobilisation for training of communities for wide actions such as sustainable management of the rangeland resources, livestock grazing management systems; erosion control and community seed production.
2. **Mobilisation for development activities**
   1. **Access to technology**: District Council should assist in mobilizing communities and establish seed multiplication by groups- quality declared seed. It should also lobby agro-dealers to invest in delivery of production inputs especially, seed, fertilizers, chicken vaccines and veterinary drugs.
   2. **Knowledge delivery**: The District Council should mobilize and provide extension staff to support lead farmers and village leaders in technology and knowledge dissemination.
   3. **Awareness creation and platforms for delivery**: The district council should assist in
      1. Sensitization and mobilization of the village communities to plant fodder trees, grasses and legume fodder species for increased quality and quantity and processing of fodder to stabilize feed availability throughout the year.
      2. Support food safety awareness raising on aflatoxin and its management for human consumption.
      3. Promote new varieties and associated production practices.
      4. Promote soil health interventions such as erosion and water management interventions, fertilizer utilization, multiple cropping systems and proper tillage practice.
3. **Enforcement and formulation of by-laws to increase productivity while conserving the natural resource base**
   1. The District Council should mobilize village communities to put in place by-laws that prevent, minimize and eradicate soil erosion. The role of poor tillage practice should be addressed.
   2. The District Council should implement and or introduce land use planning to address frequent conflicts on land use among crop and livestock farmers. Improved grazing and erosion management interventions will be more effective reducing floods, crop losses and degradation.